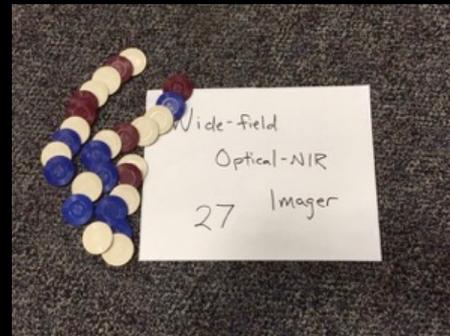
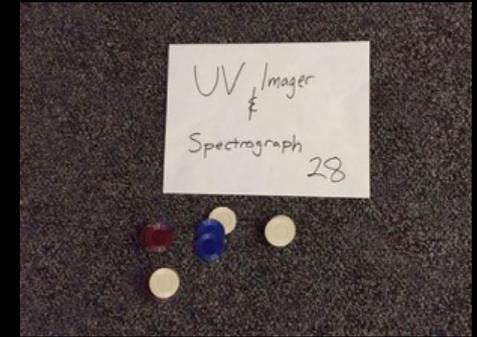


# LUVOIR instrument decision process

At 2<sup>nd</sup> STDT meeting (Aug 2016), instrument suite chosen on basis of science observation needs



# The LUVOIR instruments

## Observational challenge

Faint planets next to bright stars

## Solution

### Optical / Near-IR Coronagraph

Contrast  $< 10^{-10}$  to observe exoEarths

Low resolution spectroscopy ( $R > 150$ )

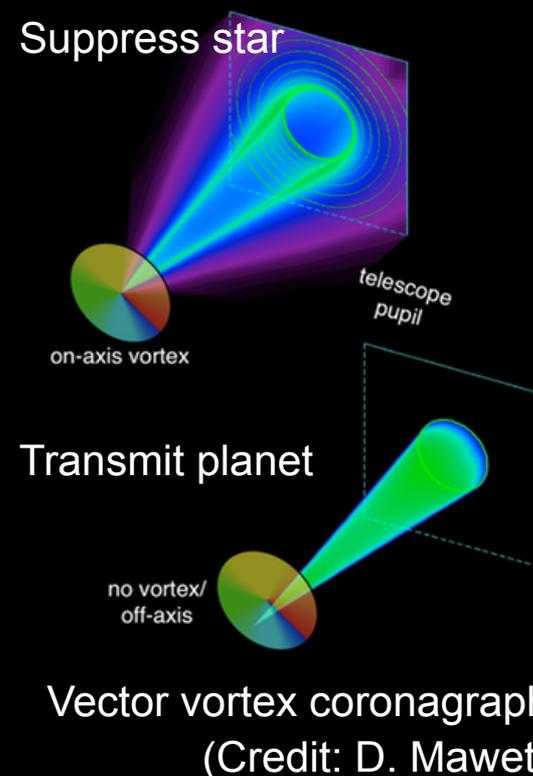
Baseline bandpass:  $0.4 \mu\text{m}$  to  $1.8 \mu\text{m}$

Ambitious bandpass:  $0.2 \mu\text{m}$  to  $2.4 \mu\text{m}$

No space-based analog



Modern Solar System  
w/ 12-m telescope



# The LUVOIR instruments

## Observational challenge

No UV through Earth's atmosphere

## Solution

### **LUMOS**

Far-UV to near-UV spectroscopy

High resolution ( $R \sim 10^5$ ) spectroscopy

Med. res. multi-object spectroscopy

Near-UV imaging

Major upgrade of HST STIS



HST STIS UV instrument

# The LUVOIR instruments

## Observational challenge

Imaging wide fields at high resolution

## Solution

### High-Definition Imager

4 – 6 arcmin field-of-view

Optical to near-IR bandpass

Possibly high precision astrometry to  
measure planet masses

Major upgrade of HST WFC3



HST Wide Field Camera 3

# The LUV0IR instruments

## Observational challenge

Measuring warm molecules present in Earth's atmosphere

## Solution

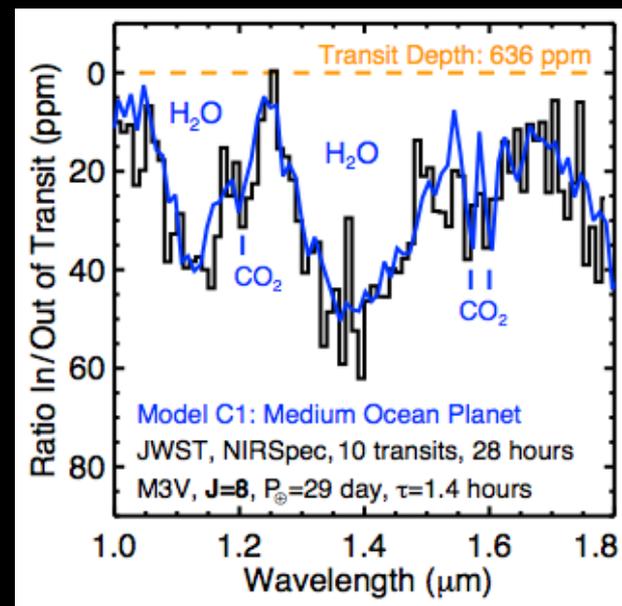
### Optical / Near-IR Spectrograph

Multiple resolutions up to  $R \sim 10^5$

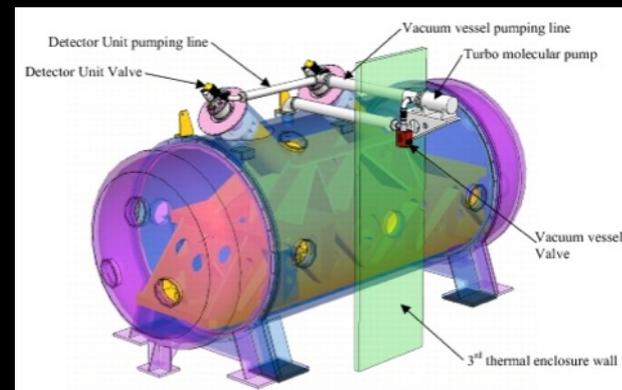
High photometric precision for transits

Possibly high precision RV to measure planet masses

No space-based analog



Credit: Natasha Batalha



ESPRESSO spectrograph for VLT (Credit: ESO)

# LUVOIR online simulation tools in development

<http://jt-astro.science/luvoir.html>

LUVOIR Performance Simulation

## LUVOIR: The Large UltraViolet Optical Infrared Surveyor



### Performance Simulation

This page links to performance simulations and visualizations for the LUVOIR mission, NASA's future concept observatory for UVOIR astronomy.

All these widgets are experimental. If they are not working email tumlinson AT stsci.

#### HDI Photometric ETC

This is the basic ETC for photometry in multiband images.

#### LUMOS Spectroscopic ETC

This is a very simple ETC for UV spectroscopy with LUVOIR.

#### Galaxy Imaging Resolution

A comparison of resolutions for a  $z = 2$  galaxy.

#### UV MOS and Stellar Clusters

See the impact of UV MOS on the study of stellar clusters and their feedback.

#### ExoEarth Atmospheres

Play around with atmosphere spectra for exoEarths of different surface composition.

#### Coronagraphic Spectra of ExoEarths

Model observations of Earth-like planets with realistic noise.

#### Exoplanet Yield Tool

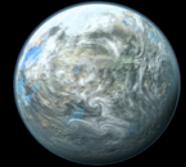
A widget for visualizing the Stark et al. ExoEarth yields.

[Learn More about LUVOIR](#)

# Difference between LUVOIR and HabEx ?

Both LUVOIR and HabEx have two primary science goals

- Habitable exoplanets & biosignatures
- Broad range of general astrophysics



The two architectures will be driven by difference in focus

- For LUVOIR, both goals are on equal footing. LUVOIR will be a general purpose “great observatory”, a successor to HST and JWST in the  $\sim 8 - 16$  m class
- HabEx will be optimized for exoplanet imaging, but also enable a range of general astrophysics. It is a more focused mission in the  $\sim 4 - 8$  m class

Similar exoplanet goals, differing in quantitative levels of ambition

- HabEx will *explore* the nearest stars to “search for” signs of habitability & biosignatures via direct detection of reflected light
- LUVOIR will *survey* more stars to “constrain the frequency” of habitability & biosignatures and produce a statistically meaningful sample of exoEarths

The two studies will provide a continuum of options for a range of futures